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Influence of Selected Variables On Certain Beef Carcass Traits

JAMES L. McBEE, JR. and DAVID H. BOWERS

Introduction

THE VALUE of a beef carcass is determined primarily by the relative proportions of muscle, fat and bone, by the distribution of these components and the acceptability of the saleable portions. Carcass measurements have been used, with varying degrees of success, to estimate these proportions and therefore the value of the carcass. Other methods, such as dissection and chemical analysis of the complete carcass, are extremely expensive.

Meat packers and retailers desire a beef carcass which has a high ratio of lean to fat and satisfactory eating quality. Two of the most frequently used objective carcass measurements to predict the lean:fat ratio are *longissimus dorsi* muscle area and subcutaneous fat thickness at the 12-13th rib. These measurements are also used in the U.S.D.A. Yield Grading System. It is probable these commonly used objective measurements are related to or influenced by other relatively easy-to-obtain measurements which could be incorporated into prediction equations to estimate desirable carcass traits.

The purpose of this study was to determine the relationships between carcass weight, carcass grade, fat thickness and length, width and area of the *longissimus dorsi* muscle. Regression equations using the above carcass traits were formulated to estimate rib eye area.

Literature Review

Several objective carcass measurements have been employed to predict the proportion of lean meat in the carcass. Hirzel (1939) utilized maximum width times maximum length of the rib eye as a measure of muscle area. Naumann (1951) recommended a procedure for measuring *longissimus dorsi* area, tracing the outline of the muscle cross-section at the 12th rib. The tracing was made on non-absorbent paper, subsequently measured with a compensating planimeter and expressed in square inches.

Weslie *et al.* (1958) reported 10 to 18 per cent of the variation in separable lean of the carcass was associated with *longissimus dorsi* area. *Longissimus dorsi* area accounted for 19 to 23 per cent of the variation in weight of trimmed wholesale cuts and weight of trimmed primal cuts according to Hedrick *et al.* (1963). Cole *et al.* (1962) reported simple correlations of 0.58, 0.59, 0.39 and 0.63 between total separable lean and *longissimus dorsi* area at the 5th rib, 12th rib, last lumbar vertebra and an average of the three area measurements, respectively. In a study by Cahill *et al.* (1956) a correlation of 0.85 was reported between *longissimus dorsi* area and per cent edible portion of the carcass.

Miller *et al.* (1965) noted that *longissimus dorsi* muscle area increased approximately 0.5 times from the lightest weight group (mean = 377 lbs.) to the heaviest weight group (mean = 878 lbs.), whereas fat thickness increased three times. *Longissimus dorsi* muscle measurements were more highly associated with weight than with per cent retail cuts. These workers found that subcutaneous fat thickness measurements were associated with two or three times as much of the variation in retail yield as was *longissimus dorsi* muscle area, and that per cent total fat trim influenced retail yield more than any other variable studied.

Merkel and Mackintosh (1961) found a correlation of -0.91 between total lean and total fat of the beef carcass. Wiles (1966) computed significant correlations of 0.21, 0.19, 0.14 and 0.23 between carcass weight and fat thickness over the rib eye and length, width and area of the *longissimus dorsi* muscle, respectively. Carcass grade was significantly correlated with carcass weight (0.88) and fat thickness over the rib eye (0.23), but not with *longissimus dorsi* muscle length, width or area. *Longissimus dorsi* muscle length was significantly correlated with width (0.33) and area (0.69), and width was significantly correlated with area (0.62).

Experimental Procedure

Carcasses from 1,672 steers were used in this experiment. Data collected included carcass weight, carcass grade, subcutaneous fat thickness and rib eye length, width and area. These cattle were slaughtered at three packing plants, with ribbing being done by various plant personnel. Carcasses ranged in weight from 210 to 937 pounds. Carcasses graded Prime, Choice, Good and Standard, and were numerically coded for statistical purposes with 1 equivalent to Prime and 4 equivalent to Standard. Fat thickness over the rib eye and rib eye length, width and area were determined according to the methods outlined by Wiles (1966).

The data were partitioned into the following weight groups:

- | | |
|-----------------------|------------------------|
| (1) below 349 pounds | (7) 600 to 649 pounds |
| (2) 350 to 399 pounds | (8) 650 to 699 pounds |
| (3) 400 to 449 pounds | (9) 700 to 749 pounds |
| (4) 450 to 499 pounds | (10) 750 to 799 pounds |
| (5) 500 to 549 pounds | (11) 800 to 849 pounds |
| (6) 550 to 599 pounds | (12) over 850 pounds |

Simple correlation coefficients were calculated for carcass grade, carcass weight, carcass weight squared, fat thickness over the rib eye, rib eye length x width and rib eye length, width and area within each weight group.

Three weight groups were made by pooling groups 1 through 4, 5 through 9, and 10 through 12. A multiple linear regression analysis was used to obtain regression coefficients for the carcass traits involved in this study. Simple correlation coefficients were calculated between the above mentioned carcass traits.

The data from all weight groups were pooled to calculate regression coefficients and simple correlation coefficients for the carcass traits.

Results and Discussion

The average carcass grade, average carcass weight, carcass weight squared, external fat thickness, external fat thickness per 100 pounds carcass weight, rib eye length, rib eye width, rib eye width x length, rib eye area and rib eye area per 100 pounds carcass weight of 1,672 steer carcasses by 50-pound weight groups, pooled into three weight groups and pooled into a single weight group, are presented in Table 1. Within the 50-pound weight groups, external fat thickness, rib eye length, rib eye width, rib eye width x length and rib eye area consistently increased with each increase in carcass weight. Rib eye area increased approximately two times from the lightest to heaviest weight group, while fat thickness increased approximately six times. The lighter weight carcasses had greater rib eye areas per 100 pounds carcass weight than the heavier carcasses. External fat thickness per 100 pounds carcass weight was essentially the same for all weight groups except the extremely light-weight carcasses. Carcass grade was consistently higher with each increase in carcass weight, with minor variations in the upper weight ranges.

When the data were pooled into three weight ranges, consistent increases in all variables were observed for each increase in carcass weight.

Simple correlation coefficients within the 50-pound weight groups are presented in Table 2. Simple correlation coefficients for the data

TABLE 1
Means for Selected Carcass Measurements Within Weight Groups

Carcass Weight Range (lb.)	Carcass Grade ^a	Carcass Weight (lb.)	Carcass Weight ²	Exter- nal Fat Thickness (cm)	Exter- nal Fat Thickness cm/100 lb. Carcass Wt.	Rib Eye Length, (cm.)	Rib Eye Width, (cm.)	Rib Eye Length x Width, (cm.)	Rib Eye Area (in.)	Rib Eye Area in ² /100 lb. Carcasses	Number of Carcasses
Below 349	3.47	302	91,990	0.50	0.17	11.95	5.24	62.83	8.12	2.69	32
350 - 399	2.86	376	137,800	0.91	0.25	12.81	5.53	71.04	8.84	2.39	7
400 - 449	2.79	433	188,000	1.31	0.30	12.69	5.76	73.22	9.27	2.14	19
450 - 499	2.39	477	228,300	1.50	0.31	12.82	5.80	74.38	9.51	1.99	54
500 - 549	2.35	525	276,300	1.76	0.33	13.29	6.08	81.01	10.20	1.94	136
550 - 599	2.22	576	332,800	1.88	0.33	13.60	6.19	84.31	10.75	1.87	253
600 - 649	2.07	624	390,000	2.01	0.32	13.82	6.40	88.52	11.31	1.81	356
650 - 699	2.06	673	453,000	2.10	0.31	14.00	6.45	90.31	11.58	1.72	389
700 - 749	1.98	721	520,500	2.18	0.30	14.16	6.50	92.14	11.74	1.63	241
750 - 799	2.06	770	593,800	2.39	0.31	14.40	6.66	96.01	12.33	1.60	126
800 - 849	2.09	820	672,000	2.60	0.32	14.69	6.79	99.80	12.65	1.54	45
850 - 899	1.67	872	760,000	2.86	0.33	15.07	7.01	105.80	13.87	1.59	12
Over 900	2.00	930	864,000	2.90	0.31	15.50	7.40	114.80	15.15	1.63	9
Below 500	2.80	413	176,800	1.14	0.28	12.55	5.62	70.68	9.03	2.19	112
500 to 749	2.11	636	408,900	2.02	0.32	13.84	6.36	88.14	11.25	1.77	1375
Over 750	2.04	791	626,600	2.48	0.31	14.53	6.72	97.77	12.54	1.59	185
Weight Group Pooled	2.15	638	417,500	2.01	0.31	13.83	6.35	88.04	11.24	1.76	1672

^aPrime = 1, Choice = 2, Good = 3 and Standard = 4.

when pooled into three weight groups and into a single weight group, respectively, are shown in Table 3 and 4.

Correlation coefficients between carcass grade and carcass weight, carcass weight² and fat thickness indicate these characteristics are positively related to the factors determining carcass grade (conformation, marbling and maturity) for carcasses weighing less than 500 pounds. Carcass weight, carcass weight² and fat thickness were not as closely related to these grade factors in heavier carcasses. Marbling was highly correlated with fat thickness and higher conformation scores were associated with heavier carcasses. Variability in fat thickness measurements and carcass weight apparently were too large to show a higher relationship in heavier carcasses.

The relationship between carcass grade and rib eye measurements declined as carcass weight increased from the light-weight group to the heavy-weight group. Variability in rib eye measurements and carcass grade apparently increased as carcass weight increased.

Carcass weight and carcass weight² were more closely related to rib eye measurements in carcasses weighing below 500 pounds than over 500 pounds. These results indicate muscling affected carcass weight more than did fat in the lighter carcasses.

External fat thickness was highly correlated with carcass grade, weight and weight² for carcasses weighing below 500 pounds. Correlations between fat thickness and rib eye area were positive for carcasses weighing less than 500 pounds, negative for carcasses weighing 500 to 750 pounds and negative for carcasses weighing over 750 pounds. When the correlations between fat thickness and rib eye area were compared within the 50-pound weight groups, all of the coefficients were negative.

Correlations between fat thickness and rib eye width indicated fat deposition increased as rib eye width increased at lighter weights. For carcasses weighing over 500 pounds, correlations indicated fatter carcasses had smaller eye measurements. Rib eye width was more highly correlated with rib eye length x width and with rib eye area than was rib eye length in some weight groups, and the opposite was true in other weight groups.

A small, but significant relationship was observed between rib eye length and rib eye width for all weight groups. Rib eye length was highly correlated with rib eye length x width and rib eye area. The high correlation coefficients between rib eye length x width and rib eye area were expected.

Multiple correlation coefficients between rib eye area and selected carcass measurements and equations for predicting rib eye area of carcasses falling within specified weight ranges are presented in Table 5.

TABLE 2

Simple Correlation Coefficients Between Selected Carcass Measurements Within Weight Groups
Carcasses Weighing Less Than 350 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	0.34*	0.34*	0.44*	0.11	0.18	0.19	0.36*
2. Carcass Weight		0.99*	0.39*	0.44**	0.49**	0.55**	0.53**
3. Carcass Weight ²			0.39**	0.46**	0.48**	0.56**	0.53**
4. External Fat Thickness				0.11	0.22	0.21	-0.07
5. Rib Eye Length					0.42*	0.77**	0.33
6. Rib Eye Width						0.90**	0.59*
7. Rib Eye Length x Width							0.58**
8. Rib Eye Area							

N=32 *P < .05 **P < .01

Carcasses Weighing 350 to 399 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	0.62	0.63	0.92**	-0.62	-0.77*	-0.72*	0.56
2. Carcass Weight		0.99**	0.84**	-0.39	-0.22	-0.26	-0.26
3. Carcass Weight ²			0.85**	-0.38	-0.22	-0.26	-0.25
4. External Fat Thickness				-0.49	-0.56	-0.54	-0.48
5. Rib Eye Length					-0.85**	0.92**	0.86**
6. Rib Eye Width						0.99**	0.82**
7. Rib Eye Length x Width							0.86**
8. Rib Eye Area							

N=7 *P < .05 **P < .01

TABLE 2 (Continued)

Carcasses Weighing 400 to 499 Pounds								
	2	3	4	5	6	7	8	
1. Carcass Grade	0.26	0.26	0.55*	-0.05	-0.07	-0.07	0.06	
2. Carcass Weight		0.99**	0.05	-0.24	-0.03	-0.12	-0.01	
3. Carcass Weight ²			0.06	-0.24	-0.03	-0.12	-0.01	
4. External Fat Thickness				-0.18	-0.33	-0.35	-0.33	
5. Rib Eye Length					0.26	0.51**	0.57**	
6. Rib Eye Width						0.92**	0.88**	
7. Rib Eye Width x Length							0.95**	
8. Rib Eye Area								
N=19 *P = < .05 **P < .01								
Carcasses Weighing 450 to 499 Pounds								
	2	3	4	5	6	7	8	
1. Carcass Grade	0.01	0.02	0.28*	-0.14	0.13	0.06	0.06	
2. Carcass Weight		0.99**	0.28*	0.20	0.15	0.21	0.02	
3. Carcass Weight ²			0.28*	0.20	0.15	0.21	0.02	
4. External Fat Thickness				-0.20	-0.09	-0.18	-0.34**	
5. Rib Eye Length					0.00	0.49**	0.41**	
6. Rib Eye Width						0.87**	0.64**	
7. Rib Eye Width x Length							0.76**	
8. Rib Eye Area								
N=54 *P < .05 **P < .01								

TABLE 2 (Continued)

Carcasses Weighing 500 to 549 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	-0.03	-0.03	0.45**	-0.41**	0.10	-0.09	0.06
2. Carcass Weight		0.99**	0.12	0.06	-0.10	-0.04	0.00
3. Carcass Weight ²			0.13	0.00	-0.10	-0.04	0.00
4. External Fat Thickness				-0.32**	-0.05	-0.17**	-0.08
5. Rib Eye Length					0.26**	0.64**	0.55**
6. Rib Eye Width						0.91**	0.74**
7. Rib Eye Width x Length							0.83**
8. Rib Eye Area							

N=136

*P < .05

**P < .01

Carcasses Weighing 550 to 599 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	0.04	0.04	0.38**	0.27**	0.18**	0.03	0.11
2. Carcass Weight		0.99**	0.08	0.04	0.08	0.08	0.09
3. Carcass Weight ²			0.08	0.04	0.08	0.09	0.09
4. External Fat Thickness				-0.26**	-0.26**	-0.33**	-0.19**
5. Rib Eye Length					0.13*	0.56**	0.52**
6. Rib Eye Width						0.89**	0.61**
7. Rib Eye Width x Length							0.75**
8. Rib Eye Area							

N=253

*P < .05

**P < .01

TABLE 2 (Continued)

Carcasses Weighing 600 to 649 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	-0.05						
2. Carcass Weight		-0.05	0.27**	-0.23	0.01	-0.09	0.00
3. Carcass Weight ²		0.99**	0.03	0.01	0.00	0.00	0.02
4. External Fat Thickness			0.03	0.01	0.00	0.00	0.02
5. Rib Eye Length				-0.27	-0.30**	-0.38**	-0.33**
6. Rib Eye Width					0.85**	0.54**	0.55**
7. Rib Eye Width x Length						0.54**	
8. Rib Eye Area							0.80**

N=356

*P < .05

**P < .01

11

Carcasses Weighing 650 to 699 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	0.02						
2. Carcass Weight		0.02	0.15**	-0.17**	0.10	0.00	0.12*
3. Carcass Weight ²		0.99**	0.08	0.12*	0.09	0.13*	0.16**
4. External Fat Thickness			0.08	0.12*	0.09	0.13*	0.16**
5. Rib Eye Length				0.06	-0.27**	-0.25**	-0.19**
6. Rib Eye Width					0.16**	0.56**	0.58**
7. Rib Eye Width x Length						0.90**	
8. Rib Eye Area							0.80**

N=389

*P < .05

**P < .01

TABLE 2 (Continued)
Carcasses Weighing 700 to 749 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	0.04	0.04	0.20*	-0.18**	0.03	0.06	0.11
2. Carcass Weight		0.88	0.05	0.01	0.00	0.00	0.01
3. Carcass Weight ²			0.05	-0.01	0.00	0.00	0.01
4. External Fat Thickness				-0.20**	-0.20**	-0.25**	-0.22**
5. Rib Eye Length					0.19**	0.59**	0.64**
6. Rib Eye Width						0.90**	0.57**
7. Rib Eye Width x Length							0.74**
8. Rib Eye Area							

N=241

*P < .05

**P < .01

Carcasses Weighing 750 to 799 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	0.04	0.04	0.14	-0.05	0.03	0.00	0.09
2. Carcass Weight		0.99**	0.03	-0.01	0.04	0.03	0.10
3. Carcass Weight ²			-0.02	-0.01	0.04	0.03	0.10
4. External Fat Thickness				-0.16	-0.27**	-0.29**	-0.28**
5. Rib Eye Length					0.20*	0.61**	0.66**
6. Rib Eye Width						0.90**	0.63**
7. Rib Eye Width x Length							0.81**
8. Rib Eye Area							

N=126

*P < .05

**P < .01

TABLE 2 (Continued)

Carcasses Weighing 800 to 849 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	-0.08		0.26	0.24	0.07	0.03	0.02
2. Carcass Weight		0.99**	-0.09	0.08	-0.07	-0.02	0.05
3. Carcass Weight ²			-0.97**	0.08	-0.07	-0.02	0.05
4. External Fat Thickness				-0.23	-0.33*	-0.39**	-0.25
5. Rib Eye Length					0.02	0.47**	0.56**
6. Rib Eye Width						0.89**	0.51**
7. Rib Eye Width and Length							0.71**
8. Rib Eye Area							

N=45

*P < .05

**P < .01

Carcasses Weighing Over 850 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	-0.38			0.46	0.64*	0.63*	0.57*
2. Carcass Weight		-0.38	-0.09	-0.50	-0.46	-0.53	-0.40
3. Carcass Weight ²		0.99**	-0.05	-0.50	-0.46	-0.53	-0.40
4. External Fat Thickness			-0.05	-0.02	-0.09	-0.07	-0.03
5. Rib Eye Length					0.60*	0.87**	0.71**
6. Rib Eye Width						0.92**	0.67**
7. Rib Eye Width and Length							0.75**
8. Rib Eye Area							

N=12

*P < .05

**P < .01

TABLE 3
Simple Correlation Coefficients Between Selected Carcass Measurements
Carcasses Weighing Less Than 500 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	0.62**						
2. Carcass Weight		0.62**	0.66**	0.22*	0.28**	0.31**	0.40**
3. Carcass Weight ²		0.99**	0.75**	0.48**	0.42**	0.52**	0.57**
4. External Fat Thickness			0.76**	0.47**	0.41**	0.51**	0.56**
5. Rib Eye Length				0.23*	0.20*	0.24*	0.23*
6. Rib Eye Width					0.33**	0.69**	0.58**
7. Rib Eye Width x Length						0.91**	0.75**
8. Rib Eye Area							0.82**

N=112

*P < .05

**P < .01

Carcasses Weighing From 500 to 750 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	0.15**						
2. Carcass Weight		0.15**	0.28**	0.17**	0.11**	0.01	0.13**
3. Carcass Weight ²		0.99**	0.21**	0.30**	0.18**	0.28**	0.35**
4. External Fat Thickness			0.21**	0.30**	0.18**	0.28**	0.35**
5. Rib Eye Length				-0.12**	-0.19**	-0.21*	-0.12**
6. Rib Eye Width					0.20**	0.60**	0.62**
7. Rib Eye Width x Length						0.90**	0.65**
8. Rib Eye Area							0.80**

N=1375

*P < .05

**P < .01

TABLE 3 (Continued)

Carcasses Weighing Over 750 Pounds

	2	3	4	5	6	7	8
1. Carcass Grade	0.09	0.09	0.18*	0.04	0.07	0.05	0.13
2. Carcass Weight		0.99**	0.18*	0.23**	0.15*	0.23**	0.32**
3. Carcass Weight ²			0.18*	0.24	0.15*	0.23**	0.32**
4. External Fat Thickness				0.11	-0.23**	-0.23**	-0.16**
5. Rib Eye Length					0.21**	0.61**	0.55**
6. Rib Eye Width						0.80**	0.61**
7. Rib Eye Width x Length							0.79**
8. Rib Eye Area							

N=185

*P < .05

**P < .01

TABLE 4

Simple Correlation Coefficients Between Selected Carcass Measurements for Pooled Weight Groups

	2	3	4	5	6	7	8
1. Carcass Grade	0.28**	0.26**	0.35**	0.91	0.18**	0.13**	0.24**
2. Carcass Weight		0.99**	0.46**	0.51**	0.35**	0.49**	0.57**
3. Carcass Weight ²			0.44**	0.50**	0.34**	0.47**	0.56**
4. External Fat Thickness				0.09**	0.03	0.01	0.11**
5. Rib Eye Length					0.31**	0.68**	0.70**
6. Rib Eye Width						0.91**	0.69**
7. Rib Eye Width x Length							0.84**
8. Rib Eye Area							

N=1672

*P < .05

**P < .01

TABLE 5

Multiple Correlation Coefficients Between Rib Eye Area and Selected Carcass Measurements and Equations for Predicting Rib Area of Carcasses

R	Sey ^a	Prediction Equation
Carcasses weighing 250 to 950 pounds		
0.57	1.22	$Y = 6.3089 - 0.1702 (\text{carcass grade}) + 0.0084 (\text{carcass weight}).$
Carcasses weighing less than 500 pounds		
0.86	0.56	$Y = 7.2933 - 0.2612 (\text{carcass grade}) + 0.0047 (\text{carcass weight}) - 0.5635 (\text{fat thickness, cm.}) + 0.0716 (\text{rib eye length} \times \text{width, cm.}).$
Carcasses weighing 500 to 750 pounds		
0.83	0.72	$Y = 6.3999 - 0.3002 (\text{carcass grade}) - 0.0018 (\text{carcass weight}) + 0.8006 (\text{rib eye length, cm.}) + 0.9570 (\text{rib eye width, cm.}).$
0.83	0.73	$Y = 5.8672 - 0.3313 (\text{carcass grade}) + 0.8403 (\text{rib eye length, cm.}) + 0.9724 (\text{rib eye width, cm.}).$
0.81	0.76	$Y = 6.1466 + 0.7890 (\text{rib eye length, cm.}) + 1.0180 (\text{rib eye width, cm.}).$
Carcasses weighing over 750 pounds		
0.83	0.75	$Y = 6.7022 - 0.2532 (\text{carcass grade}) - 1.0567 (\text{rib eye width, cm.}) + 0.1376 (\text{rib eye length} \times \text{width, cm.}).$
0.82	0.77	$Y = 33.0232 - 1.0222 (\text{rib eye width, cm.}) + 0.1365 (\text{rib eye length} \times \text{width, cm.}).$

^aStandard error of estimate.

Summary

Carcass weight, carcass grade, subcutaneous fat thickness and rib eye length, width and area measurements were obtained from 1,672 steer carcasses representing the four top grades and a wide weight range. These carcasses were partitioned into various weight groups and simple correlation coefficients were calculated between carcass traits. A multiple linear regression analysis was used to obtain regression coefficients for the carcass traits in this study.

Carcass grade was highly correlated with carcass weight, carcass weight² and fat thickness in the lighter weight group. Correlations between carcass grade and weight, fat thickness and rib eye measurements

declined as carcass weight increased. These results were attributed to the relative rate of muscle and fat deposition as carcass weight increased.

Carcass weight and weight² were more highly correlated with rib eye measurements in carcasses weighing less than 500 pounds than over 500 pounds. Muscling affecting weight in carcasses weighing less than 500 pounds more than did fat.

High correlations were obtained between fat thickness and carcass grade, weight and weight² for carcasses weighing less than 500 pounds. This resulted from fat being deposited more rapidly as the weight of the carcasses increased toward 500 pounds. Correlations between fat thickness and rib eye length were low and inconsistent in sign. Correlations between fat thickness and rib eye width, rib eye length x width and rib eye area indicated fat deposition increased as rib eye measurements increased in carcasses weighing less than 500 pounds. In carcasses weighing over 500 pounds, more fat was being deposited in proportion to the increase in rib eye measurements.

Rib eye length was not highly correlated with rib eye width, but length and width were both highly correlated with rib eye length x width and rib eye area.

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